APPROVAL SHEET FOR SUSPENDED LOAD OPERATIONS

SLO-KSC-2000-003

TITLE Install Solar Array Assemblies on the Integrated Equipment Assembly (IEA).

DOCUMENT NUMBER/TITLE L5533, Flight Hardware/GSE Multi-Purpose Hoisting

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DATE Jul 17, 2000

REQUIRED APPROVAL

CONTRACTOR	____ DESIGN	____ R & QA	X OPERATIONS	X SAFETY
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NASA SUSPENDED LOAD OPERATION
ANALYSIS/APPROVAL

OPERATIONS

Install two Solar Array Assemblies on the Integrated Equipment Assembly (IEA) in the Space Station Processing Facility (SSPF).

SUPPORTING DOCUMENTS - The associated operational procedure and System Assurance Analysis (SAA) are as follows:

- OMI L5533, Flight Hardware/GSE Multi-Purpose Hoisting
- TPS- TBD, Solar Array Assembly Installation
- SAA21CRS1-001, 30 Ton Highbay Bridge Cranes - Space Station Processing Facility (SSPF)

GENERAL DESCRIPTION

Installation of the Solar Array Assemblies on the IEA requires four (4) technicians to be under the suspended load to guide the Solar Array in place and install the attaching hardware. Two (2) technicians will be partially under the suspended load on top of the IEA to position and attach the upper mounts to the Solar Array Assembly. The other two (2) technicians will be under the suspended load and IEA to position and attach the two (2) lower mounts to the Solar Array Assembly.

This task will be repeated twice for each of the four (4) Integrated Equipment Assemblies.

RATIONALE/ANALYSIS - The suspended load tasks comply with the NASA Alternate Safety Standard as follows:

Alternate Standard Requirement #1a

There is no alternate access to the attach points located on IEA. The Solar Array and IEA mating operations have been evaluated for alternate methods to complete these tasks, and it has been determined that the physical limitations preclude any design, operational, or procedural means to eliminate personnel exposure to a suspended load.

Alternate Standard Requirement #1b

The possible use of a secondary support system, to catch the load in the event of a crane failure, was analyzed. It was determined that the use of a secondary support system was not feasible because of the lack of room between the Solar Array Assembly and the IEA.

Alternate Standard Requirement #1c

The maximum number of personnel permitted under the suspended load while guiding the Solar Array Assembly to the IEA and installing the attaching hardware is four (4) technicians.

Alternate Standard Requirement #1d

Guiding the Solar Array Assembly to the IEA will be accomplished as quickly and safely as possible to minimize exposure time. It will take four (4) technicians a maximum of 60 minutes to guide and attach each Solar Array Assembly to the IEA.

Alternate Standard Requirement #2:

Suspended load operations are reviewed and approved on a case-by-case/specific need basis - see General Description and Alternate Standard Requirement #1.

Alternate Standard Requirement #3:

Only those suspended load operations approved by the NASA Safety & Mission Assurance Division Chief will be permitted. The NASA Safety & Mission Assurance Division Chief will maintain a list of approved suspended load operations.

Alternate Standard Requirement #4

OMI L5533 will be revised to permit only the approved people under the suspended load. The OMI will be available on site for inspection during the operation.

Alternate Standard Requirement #5:

A new suspended load operation not covered by this SLOAA, deemed necessary due to unusual or unforeseen circumstances where real time action is required, shall be documented and approved by the NASA Safety & Mission Assurance Division Chief.

Alternate Standard Requirement #6

The suspended load operations addressed in this analysis involve one of the 30 ton SSPF bridge cranes. The cranes are designed, tested, inspected, maintained, and operated in accordance with the NASA Safety Standard for Lifting Devices and Equipment, NSS/GO-1740.9.

The SSPF 30 ton crane hoists are equipped with two magnetic holding brakes, each capable of holding the load up to the crane's rated capacity. Each brake's ability to hold the rated load (30 tons) is verified annually. The cranes are designed to meet a 5 to 1 safety factor based on ultimate strength for the hoist load bearing components. The 30 ton cranes are load tested annually at 100% of their rated capacities. Detailed preventive maintenance is performed monthly, quarterly, semiannually, and annually on the cranes to ensure proper operation. A detailed inspection of the lifting fixtures is performed annually. Nondestructive testing of the crane hooks is performed annually.

Alternate Standard Requirement #7 - An SAA has been completed on the 30-ton bridge cranes in the SSPF. The SAA includes a Failure Modes and Effects Analysis/Critical Items List (FMEA/CIL) and a hazard analysis. No critical single failure points were identified during this analysis.

Alternate Standard Requirement #8 - Visual inspections for cracks or other signs of damage or anomalies are performed on the hoist hooks, hoist beams, hoist cables, hoist rod assemblies, and hoist fittings, and crane functional checks are performed before each operation per NSS/GO-1740.9.

Alternate Standard Requirement #9 - Trained and licensed crane operators shall remain at the hoist controls while personnel are under the load.

Alternate Standard Requirement #10 - Appropriate safety control areas are established before initiating operations. Only the minimum number of people (manloaded in the procedure) will be permitted in this area.

Alternate Standard Requirement #11 - A pretask briefing and a safety walkdown of the area will be conducted prior to the lift to ensure that all systems and personnel are ready to support. All participants are instructed on their specific tasks and warned of potential hazards. Following any crew change, the new personnel are instructed by the task leader on their specific tasks and warned of any hazards involved.

Alternate Standard Requirement #12 - The personnel beneath the suspended load will be in voice contact with the hoist operator and/or task leader. Upon loss of communication, the operation shall stop immediately, personnel shall clear the hazardous area, and the load shall be safed. Operations shall not continue until communications are restored.

Alternate Standard Requirement #13 - Personnel working beneath the load shall be in continuous sight of the hoist operator and/or task leader.

APPROVAL: **DATE:**

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